unable to attend

Multiplexed Pulsed Quantum Cascade Laser Based Hypertemporal Real-Time Headspace Measurements

Charles Harb
UNSW Canberra

Recently developed real-time hypertemporal headspace spectroscopic measurements systems have made it possible to gather cavity enhanced spectra over a wide-bandwidth, with the aim to make headspace measurements of molecules at trace levels. These new systems can measure spectral regions in excess of 1400 nm in a few seconds and contain at least 150, 000 spectral wavelength datapoints. However, the spectral fingerprint of medium to heavy molecules (such as nitromethane, acetonitrile, acetone, nitroglycerin, and so on), cover a much wider wavelength range. In most cases the molecular fingerprint can be anywhere in the 3 μm to 20 μm wavelength range. The standard configuration to produce a wide-band, cavity enhanced spectrometer, such as multipass cells or multiple lasers, combine multiple lasers into a single optical beam then pass the combined beam though the cavity enhanced mirrors, but they require an optical setup to split the laser beams at the output so that they can be detected on separate detectors. A more desirable approach is to detect the light exiting the cavity on a single photo receiver. This setup cannot be used by standard cavity enhanced schemes unless the laser sources are addressed in series, hence allowing only one laser to monitor the sample at a time. This, in turn, makes the measurement process substantially longer. Alternatively, the spectra could be obtained by illuminating the cavity with all the lasers simultaneously, but a new digital signal processing method is required to deal with this multiplexed spectroscopic system. The advantage of this approach is that only one detector is required and the optics separating the beams at the output of the cavity can be eliminated.